

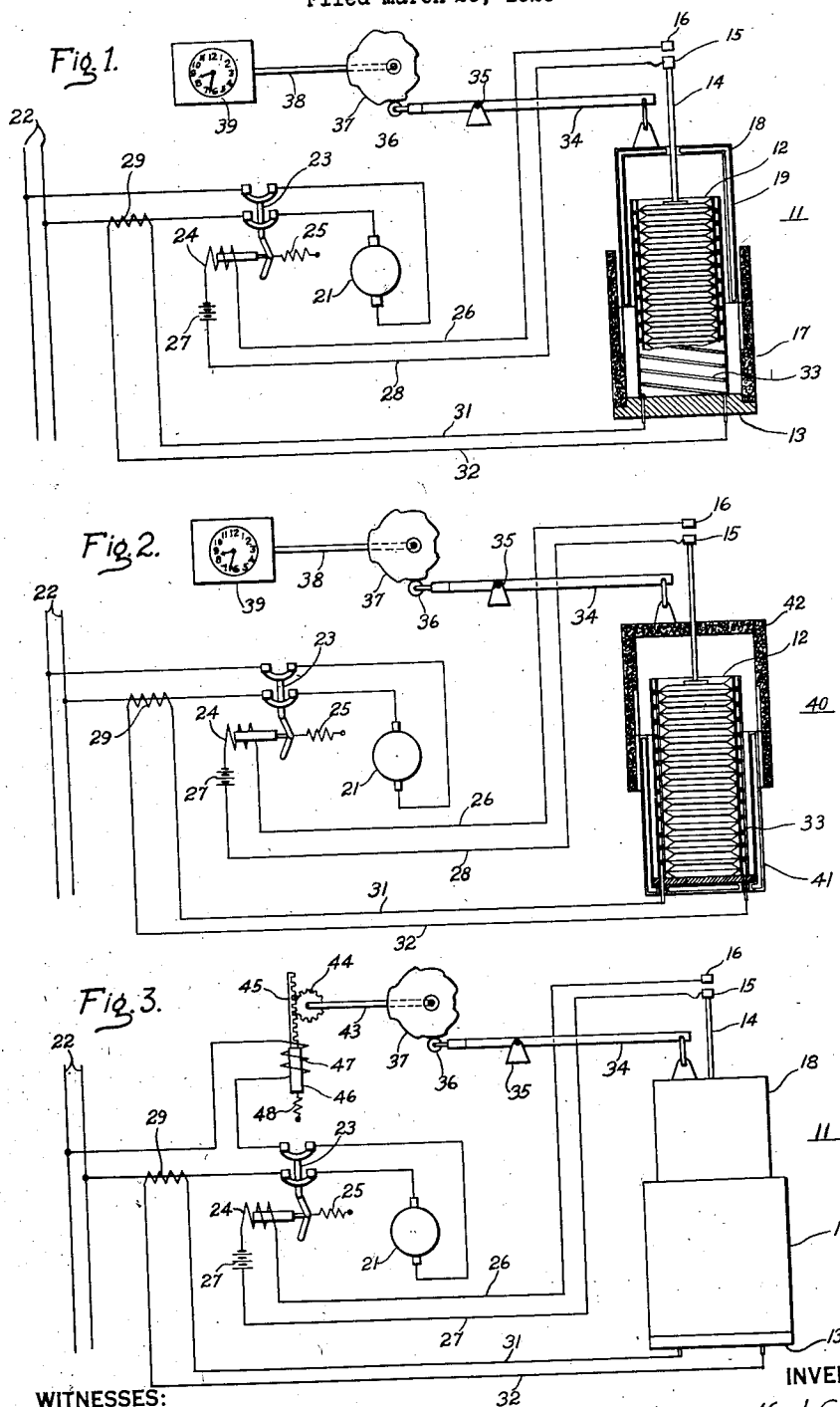
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THERMAL RELAY

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WITNESSES:

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THERMAL RELAY.

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My invention relates to thermally-actuated devices and particularly to thermal relays.

One object of my invention is to provide a thermal relay having automatically-variable heat-storage characteristics.

Another object of my invention is to provide a thermal relay having cam-controlled jacketing means for varying the time of operation thereof.

In practicing my invention, I provide a thermally actuated means of any desired type, with adjustable jacketing means comprising heat-insulating, and heat-storage members. An electric heating element is operatively associated with the thermally actuated device and is energized in accordance with an electrical condition of an external electric circuit, the energization of which in turn is controlled through suitable means by the thermally actuated means. The position of the jacketing means is varied by a cam which is, in turn, actuated by time, or by current-controlled means.

In the single sheet of drawings,

Figure 1 is a view, in vertical section, of a thermally-influenced means and a schematic diagram of connections of circuits associated therewith.

Fig. 2 is a substantially similar view, illustrating a modified form of construction of thermally-influenced means, and

Fig. 3 is a similar view of a further modification of the device and system embodying my invention.

Referring more particularly to Fig. 1, I have there illustrated a thermally influenced means 11 that comprises an expansible or movable member 12, of substantially bellows shape, having one end mounted on a substantially fixed member or base 13. The other end of the expansible member 12 is operatively connected to a rod 14 that has mounted at the outer end thereof a contact member 15 that is adapted to operatively engage or be disengaged from a substantially fixed contact member 16.

The thermally-influenced or actuated member 11 is provided with a heat-insulating jacketing means 17 that may be of any suitable construction, but is here shown as comprising a substantially tubular member supported by the base 13 and surrounding the lower portion of the expansible member 12. A heat storage member 18 is of inverted bell shape and may comprise a double wall vessel

of any suitable or desired construction that may be filled with a quantity of suitable heat-absorbing fluid 19. In this modification of the thermally influenced device 11, the heat insulating member 17 is made substantially fixed and the heat-storage member 19 is made movable relatively thereto.

While I have illustrated a specific embodiment of the thermally actuated means, I do not desire to be limited thereto, as the particular, construction of this portion of the device forms no part of my invention, and any suitable or desired type of means that may be thermally influenced comes within the scope of my invention.

An energy translating device 21 that is here represented as an alternating current motor, but which may comprise any form of electric energy translating device, such as a rotary converter, a transformer or a generator, is connected to the conductors of a supply circuit 22. A circuit breaker 23 is connected in the circuit between the conductors 22 and the energy translating device 21, and comprises an actuating coil 24, a spring member 25, together with the usual stationary contacts and bridging contact members.

One terminal of the coil 24 of the breaker 23 is electrically connected to the contact terminal 16, by a conductor 26, while the other terminal of the coil 24 is connected to one terminal of a suitable source of supply of electric energy 27, the other terminal of which is connected to the contact terminal 15, by a conductor 28.

A transformer 29, that is illustrated schematically only, is connected in the circuit of the energy translating device 21 and has the terminals of its secondary winding connected by conductors 31 and 32 to the terminals of a heating coil 33 that is operatively associated with the thermally-actuated device 11.

The construction of the transformer 29 is such that the current traversing its secondary winding and the heating coil 33, is substantially in accordance with the current traversing the energy translating device 21, whereby the thermally actuated device 11 is energized, through the heating coil 33, substantially in accordance with an electrical condition of the energy translating device and of the circuit connected thereto, and more particularly in accordance with the current traversing the same.

The heat storage member 18 is pivotally

connected to one end of a lever 34 that is pivotally mounted, between its ends, on a suitable support 35. The lever 34 is provided, at the end opposite to the end supporting the member 18, with a suitable roller 36 that is in operative engagement with a cam member 37 having a plurality of stepped surfaces or faces. The cam member 37 is suitably mounted to permit of its having a turning movement and is actuated by a shaft 38 that is, in turn, actuated by a suitable clock-mechanism 39. I have not illustrated the specific mechanical details of the cam and shaft mounting as they form no part of my invention and any construction suitable to effect the desired results may be employed.

Referring more particularly to Fig. 2 of the drawing, I have there illustrated particularly a modified form of construction of thermally influenced or actuated device 40. A heat-receiving means and heat-storing means 41 is made substantially stationary, its construction being changed to permit of mounting it stationary relative to the other parts of the device. A heat-insulating means 42 is located around the upper portion of the expansion member 12 and is made movable relatively thereto. The member 42 is pivotally connected to one end of a lever 34 that is pivotally mounted on a suitable support 35.

All of the other portions of the control system are substantially the same as were hereinbefore described in connection with Fig. 1, and will not be further described in detail.

In Fig. 3 of the drawings, I have illustrated a modified form of automatic control for the cam member 37 and only such portions of the system as are different from the other systems will be described.

The cam member 37 is mounted on a shaft 43 at one end and a gear wheel 44 is mounted on the other end thereof. The gear wheel 44 is operatively engaged by a rack bar 45 that is mechanically connected to a core member 46, whose position is controlled by a magnetizing winding 47. The winding 47 is connected in the circuit of an energy translating device 21 and is traversed by the same current. A spring 48 is connected to the other end of the core member 46. The cam member, shaft, gear wheel and the adjustable rack bar have all been shown schematically only, in order that the construction and operation of this part of the device may be clear.

Referring more particularly to Fig. 1 of the drawing, the operation of the circuit and of the device is substantially as follows: The energy translating device 21 is to be considered as a device that has a predetermined load cycle with reference to the twenty-four hours of a day or to a portion thereof. It is desired that the thermally-influenced device 11 protect the energy translating device 21, throughout its entire variable load cycle.

If for instance, the energy translating de-

vice 21 is to be operated at normal load during certain hours of the day, while during other hours of the day its load may be progressively increased to 25, 50 and 75% overload, it is desired that the thermal capacity of the thermally-actuated means be varied so that it will still protect the energy translating device and cause it to be disconnected from the supply circuit should it reach a dangerously high temperature.

If the output of the energy translating device is to be maintained either by manual or by automatic means at substantially 25% overload, the thermal capacity of the device 11 will be less than when the load is to be maintained at 150% of the normal output. Hence, the stepped faces of the cam member 37 must be so proportioned that when the cam member is rotated by the clock 39, the position of the heat-insulating means 18 will be such as to provide thermal capacity suitable to permit the relay 11 to properly protect the energy translating device against the effects of overload thereon, if maintained for too great a length of time.

As hereinbefore noted, the heat storage means 18 is made adjustable relatively to the expansion member 12, in Fig. 1, while in Fig. 2, of the drawing, the heat-insulating member 42 is made adjustable relatively thereto. If the load should become too great, or the overload should be maintained for too great a length of time, the expansion member 12 will, under the influence of the heat generated in the resistor coil 33, expand to such an extent that the contact member 15 operatively engages the contact member 16, whereby an energizing circuit is closed through the coil 24, which attracts its core member and causes the breaker to move to its open position, thereby interrupting the supply of energy to the energy translating device 21.

After the supply of energy to the energy translating device 21, has been interrupted for a sufficiently long period of time to permit the thermal relay 11 to cool sufficiently to cause contraction of the expansible member 12, the contact member 15 will be disengaged from the contact 16, whereby the actuating coil 24 is deenergized and the spring 25 will cause the circuit breaker to close, thereby again energizing the device 21.

Referring more particularly to Fig. 3 of the drawing, the thermal capacity of the thermal relay 11 is automatically adjusted in accordance with an electrical condition of the energy translating device 21, more particularly the current traversing the same. However, fluctuations in voltage will also be taken care of inasmuch as a higher voltage supplied to the energy translating device will cause a greater current to traverse the same, thereby causing a greater current to traverse the heating coil 33.

In this particular system, we may consider

that predetermined overloads are to be carried by the energy translating device 21, and it is desired that the thermal relays properly protect this device against the injurious effects if such overloads continued for too long a time. The cam faces on the cam member 37 are so proportioned that the heat retaining means 18, which is here made adjustable, will be moved to the proper position to cause the thermal relay 11 to have a thermal capacity that is substantially in accordance with the respective overloads on the device 21.

When the energy translating device 21 is loaded to such an extent that it is carrying 150% of its normal load, the core member 46 will be moved to a predetermined position, thereby causing a turning movement of the shaft 43 and of the cam member 37, and it may be assumed that this predetermined position is the one illustrated in the drawing.

Should the energy translating device 21 be of such construction that a continuance of the overload for, say ten hours, would be injurious, the thermal capacity of the thermal relay 11 is such, that it will cause the expansion of the member 12 within this time to such an extent as to cause the contact 15 to engage the contact 16, thereby causing deenergization of the energy translating device 21.

Should the load on the device 21 increase to 175% of the normal, the core member 46 will be moved to a new position thereby causing a turning movement of the cam 37 and varying the thermal capacity of the device 11 in accordance therewith.

The thermal capacity of the device 11 may now be considered such that engagement of the contact members 15 and 16 will be effected by the expansion member 12 within say five hours, thereby causing de-energization of the energy device.

In case of still higher loads, say 200% of normal, the thermal capacity would be again changed in substantially the same manner as hereinbefore noted, and deenergization of the energy translating device 21 might be effected, after say about one or two hours of operation at such a load or even shorter periods of time, in accordance with the capacity of the energy translating device.

The device embodying my invention thus provides a thermal relay embodying automatically variable means for changing the thermal capacity thereof to accord with a predetermined variable load cycle of an energy translating device which it is to protect to the effect that it may suitably protect the translating device against injurious effects of excessive overloads or of overloads that are continued for too long a time.

While I have shown a separate source of energy 27 for actuating the circuit breaker, it is obvious that the supply circuit itself may constitute the source of energy, a suitable

transformer being employed in a manner well known in the art.

Various modifications and changes may be made without departing from the spirit and scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

1. In a thermal relay, the combination with thermal means, and a heating coil therefor, of means for automatically varying the thermal capacity of said thermal means.

2. In a thermal relay, the combination with thermally movable means, and an electric circuit controlled thereby, of cam-actuated means for varying the thermal capacity of said thermally movable means.

3. In a thermal relay, the combination with thermally movable means adapted to be operatively associated with an energy translating device having a predetermined load cycle, and a controlling means therefor, of means for varying the thermal characteristics of a predetermined thermally movable means in accordance with said load cycle.

4. In a thermal relay, the combination with thermally-actuated means, an electric circuit controlled thereby, and an electric heating coil operatively associated with said thermally-actuated means and energized in accordance with the current in said electric circuit, of means actuated in accordance with the current in said circuit for varying the thermal capacity of said thermally-actuated means.

5. In a thermal relay, the combination with thermally-actuated means adapted to be operatively associated with an energy-translating device having a variable load cycle, and means for controlling the energization of said device controlled by said thermally-actuated means, of means for automatically varying the thermal-capacity of said thermally-actuated means in accordance with said load-cycle.

6. In a thermal relay, the combination with thermally-actuated means adapted to be operatively associated with an energy-translating device having a variable load cycle, electric means for heating said thermally-actuated means in accordance with said load cycle, and means for interrupting the circuit through said energy-translating device, controlled by said thermally-actuated means, of means for varying the time of operation of said thermally-actuated means independently of said electric heating means.

7. In a thermal relay, the combination with thermally-actuated means and an electric heating element, energized in accordance with an electrical condition of an external circuit, for effecting a variation in the time of operation of said thermally-actuated means, of

jacketing means associated with said thermally-actuated means for independently varying the time of operation thereof in accordance with a predetermined cycle.

- 5 8. In a thermal relay, the combination with thermally-actuated means and an electric heating element, energized in accordance with an electrical condition of an external circuit, for effecting a variation in the time of opera-

tion of said thermally actuated means, of cam-controlled jacketing means associated with said thermally-actuated means for independently varying the time of operation thereof in accordance with a predetermined cycle.

In testimony whereof, I have hereunto subscribed my name this 13th day of March 1925.

KARL C. RANDALL.